DEPARTMENT OF DEFENSE BLOGGERS ROUNDTABLE WITH JAMES VALDES, SCIENTIFIC ADVISOR FOR BIOTECHNOLOGY, U.S. ARMY RESEARCH, DEVELOPMENT AND ENGINEERING COMMAND VIA TELECONFERENCE TIME: 1:02 P.M. EDT DATE: TUESDAY, JUNE 17, 2008

(Note: Please refer to www.dod.mil for more information.)

MODERATOR: We're pleased to have Dr. James Valdes. He's the scientific advisor for Biotechnology with the U.S. Army Research, Development and Engineering Command.

He's available to talk specifically about biotechnology and also a program that a lot of you have already heard about recently: the TGER program, the Tactical Garbage to Energy Refinery, which is currently being tested in Iraq right now. So he'll be speaking to that program.

He'll start out with a few minutes of opening remarks. And then we'll open to your questions. I'll go ahead and go down the line and see who has calls, who has questions specifically. He'll answer those. We have about 30 minutes, is our max time. But we'll wrap up sooner, if the calls taper off.

So with that, again, Dr. James Valdes.

MR. VALDES: Okay. This is Jay (sp) Valdes. It's called TGER (pronouncing it as "tiger"), by the way, not "tigger."

MODERATOR: Sorry, I can't help it.

MR. VALDES: "Tigger" is the diminutive. But this actually goes back quite a few years to about the year 2001, when a study came out from the Academy of Sciences that was looking at applications in -- well, it was entitled applications in biotechnology -- or Opportunities in Biotechnology for Future Army Applications.

And what the study was looking at was, you know, the sort of nontraditional biotechnology, I call it. Up until recently, most biotechnology's been vaccines and therapeutics, things like that, has been medical. And so what the academy was looking at was are there any applications in the nonmedical area, in things that one wouldn't think about, like computation or things like armor, logistics, things like power and energy and fuel. And the paper was actually published in, I think it was, August of 2001.

And one of the areas that was sort of low-hanging fruit was power and energy, and specifically fuel. So our initial idea was that we could generate fuel in theater. A deployed battlefield army generally -- about its top logistical nightmare is fuel. And then if you look at the consumption of fuel,

it's pretty surprising. If I were to ask most people, you know, what uses the fuel in a deployed battlefield army, they'd say, you know, tanks, helicopters, things like that. And in reality, the two top -- or the three top consumers of fuel are the stoves, the generators, and then the trucks that carry the fuel.

So if you look at fuel, about 50 percent of the fuel that's used is used to transport fuel. So that's a big waste right there. Then of the fuel that gets someplace and is actually used, about half of that is used at fixed installations for things like stoves and generators. So stoves and generators don't need high-quality fuel. And so there was a real opportunity, we thought, to address a big logistics issue that the Army has.

And on top of that, it's a security issue. Those convoys that carry fuel are also known as targets.

So in general terms, about the eighth biggest logistics issue is garbage. Now, we've got a lot of garbage at various operating bases, and it's got to go someplace. And so typically they hire contractors to come on base and haul the garbage away. That's a security risk because the contractors are locals and you have to have people following them around, ensuring that they're not carrying bombs or anything of that sort.

The other way that we dispose of trash is by burning it, you know, in these giant incinerators. And they consume a huge amount of fuel. So that's an issue right there.

So our logic was that at a forward operating base, could we use the garbage to make fuel and thereby get rid of the garbage and help to keep the convoys off the streets. And so that's how TGER got started. TGER was called the Tactical Hybrid Refinery due to its hybrid technology, but the Army likes acronyms that sound like something so they changed it to TGER.

So that's sort of my introductory comments in a nutshell. If you could hold on one second, I've got to shut my door. There's a bunch of noise outside there. And I'll be happy to answer any technical questions or other kinds of questions.

Okay, I'm back.

MODERATOR: Are you ready for questions, sir?

MR. VALDES: I am ready.

MODERATOR: Maggie, did you have a question?

Q I don't know enough to ask a question, so I'll keep listening.

MODERATOR: (Laughs.) Okay. Martin, did you have a question?

Q Well, yeah, sure. Well, maybe you could just tell us about the technology. I mean, it's just an open question, really. I mean, I know -- well, I mean, are you burning the trash? What do you do in the trash and what kind of fuel are you getting on the other side? MR. VALDES: Okay, good question. Our first thought was that we wanted to produce fuel, as in liquid fuel. But the specifications for fuel that goes into trucks and tanks and helicopters are very strict.

And as one might think, the sort of waste stream that goes into TGER is a mixed waste stream: It's paper; it's plastic; it's ammunition wrappers; it's food slop garbage. And so getting a really high- quality fuel source out is kind of a problem.

So we decided instead to design a system that would convert the trash into power. And so its output is electrical power.

The technology is a hybrid. There's -- I don't know -- there's probably at least 20 different technologies out there we kind of looked at at first, and it ranges from plasma-arc technology to just incineration. And if you look at the different technologies, they're good for different applications.

There is a process in which trash gets heated -- it's not burned, but it's heated in a downdraft gasifier. And that heating process will actually turn it into hydrocarbons that sort of look like propane. So it's kind of a low-grade propane -- it's a syn-gas -- you know, it's a synthetic gas type of an output. The problem with gasifiers is that they can use plastic, they can use cardboard and paper and other products like that, other waste streams, but the output is sort of a very low fuel, or it's a low-energy fuel. And also these downdraft gasifiers are not very good at handling wet waste, like foods and liquids.

On the other hand, you can take foods and liquids, things like sugars -- they drink a lot of Kool-Aid at the DFACs -- the mess hall -- and a lot of high sugar, high carbohydrate content foods. And you can ferment them into ethanol.

So we went with the hybrid technology, because on one side is this down draft gasifier that will heat up the paper and the plastic and the styrofoam and all that. And it breaks it down. It doesn't burn it, does not burn it. It breaks it down into these real, simple, long-chain hydrocarbons. And the output is this gas, like a propane- type gas.

But on the other side of TGER, there is the food waste and other wet waste that goes into it. And that's turned into hydrous ethanol. So it's ethanol that's about 85 percent pure. And that extra 15 percent is water. And that actually works out fairly well, and I'll explain why in a second.

We then take the synthetic gas that's coming off the gasifier. And it's blended with the hydrous ethanol that comes out of the fermenter. And then that gets aspirated into a generator. And that powers a generator.

If you just used the gas that comes off the gasifier, when the generator, which is a standard 60-kW Army genset, when that generator starts to power up, just using syngas or this type of gas that comes off the gasifier, it will top out at about probably 40 kW. And then it starts to get too hot. It starts to smoke. It knocks. And that's not good for it.

When you blend in the hydrous ethanol, it's got the ethanol. That adds a lot of power, a lot of BTUs. And it's got the water. And that acts as an anti-knock agent. It cools it down. So as it worked out, this blend of the syngas with the hydrous ethanol is a really nice fuel for generators. And so that powers our generators.

Q Okay. All right.

How do you say that? Hydrous ethanol, is that how you say it?

MR. VALDES: It's hydrous.

Q Okay.

I'm sorry, so that is made by fermenting.

MR. VALDES: That's correct.

Q Oh, okay. All right. So you have that sort of in reserve when you're actually running the -- when you're actually putting trash in? Is that when you have it?

MR. VALDES: Well, what we actually do with TGER is, there's a build-up time, a start-up time of about six hours.

Q Okay.

MR. VALDES: And after that it just runs. So what we do is, when we first start it off, the generator is actually running primarily on diesel. Then as we feed in the trash, what happens is that the wet waste, the food slop, gets sort of washed off and that's taken into a tank where we add yeast and enzymes and it makes alcohol. The other waste, the plastic and the paper and the styrofoam, that gets ground up, then it gets pelletized into little fuel pellets that are about an inch long and about a quarter of an inch thick. And those pellets then go into the down-draft gasifier and are heated up and broken down.

This process of getting the TGER up to full power takes about six hours. What happens is, as we bring it up to full power, we start to drop the amount of diesel fuel that's going into the generator, until finally it's at about a 5 percent drip. So when TGER is running at steady state, about 95 percent of the energy that it produces is coming from garbage, and only 5 percent is coming from diesel.

Q One other question. Is this -- I actually wrote an article about research from Purdue University. It sounded a lot like this.

MR. VALDES: That's our partner.

Q Oh, I see. Okay, got it. All right.

MR. VALDES: So you've probably seen TGER somewhere, then. (Laughs.)

Q I think I must have seen the prototype, but not -- or a photo of it, anyway, but not the actual.

MR. VALDES: Yeah. There are two prototypes right now. We actually constructed the first prototype, I think it was completed December 2006, and then we constructed prototype number two, and that was completed sometime this past spring. And so they're both over in Baghdad right now at Victory base camp. Q Okay. What are the plans for building and deploying these things?

MR. VALDES: Well, first we have to test it out. These are prototypes. They are constructed -- they're hand built with parts that really were not primarily meant to do what those parts are now doing. For example, there's an

auger that grinds up the waste. That auger is an agricultural auger, which was not really designed for this. So it's a prototype.

And we chose Victory base camp because we wanted to have a very low infrastructure, very harsh environment in which to test out the TGERs. And there's an old Chinese maxim, be careful what you wish for, you might get it. We got it. It's 112 yesterday over there in Baghdad, and so that's a harsh environment.

So, what we're doing right now is we've got to test out the two prototypes.

They each have sensors on all of their major components. So there's a sensor on the gasifier, there's a sensor on the distillation column, on the tanks -- (brief audio break) -- generator, so that we're collecting a lot of data telling us how these TGERs operate under hot weather conditions, cool weather, under stresses of various types.

Once we're through with this 90-day testing time, we've got to analyze those data, and then what we plan on doing is a clean sheet engineering design. You know, start from scratch and say: Okay, given what we now know about the design of the TGERs and about how they operate and about how the various components operated under stress or under high maintenance, how would we design a system from scratch that could be manufactured?

Q Okay.

MODERATOR: Okay, I believe we had one other person join in on the call later. Is there someone else on the call?

Q Yeah, this is Mark Danziger.

MODERATOR: Thanks. Do you have a question, Mark?

Q Actually, I had a couple of them. So -- several have been answered. We're looking at two prototypes today. Do we have sort of a test and deployment schedule for these?

MR. VALDES: They are deployed right now. The two prototypes are currently deployed, and the test schedule is that the testing started on or about March -- or not March -- on about May 2nd and will be completed about August the 2nd.

Q Interesting.

MR. VALDES: Yeah?

Q What would the total diesel burden be to generate the 40 kilowatts? You guys were -- I'm sorry. Is there an echo on everyone's line, or just mine?

Q Yeah, it's echoing.

Q I'm sorry about that. Let me try a different phone. Hang on a second. MODERATOR: I think that our line quality might not be the best, so I do apologize about that, but --

Q No, that's okay -- no, that's still there. Basic question would be, so if you're -- can drop the diesel consumption from 100 percent to 5 percent on one of these to generate 40 kilowatt-hours, how much diesel are you actually saving?

MR. VALDES: Okay, I don't have those numbers in front of me. Hang on one second. I'll see if I can -- I do have a table here somewhere that we have looked at. Okay.

Steady-state TGER performance at 55 kilowatts -- it's not quite 60. Power efficiency is 90 percent. The consumption of diesel per hour of a generator just running on diesel is about five gallons per hour. And we cut it down to about a gallon per hour, so that's a savings.

Q Got it.

MR. VALDES: Which is fairly significant if you're talking about, you know, it's 80 percent savings.

Q Yeah, no question.

MODERATOR: Were there any other questions?

Q Yeah, I had a couple others. This is Martin LaMonica. Just --- so just logistically, do the people -- I mean, you know, I'm imagining there might be some resistance to this, because people say before we just had a generator with a diesel, you know, tank nearby -- I'm not exactly sure how it's all set up, but now they need to separate the weight. Is that right? What's the burden on the people actually using that?

MR. VALDES: Well, that's an interesting question, because the standard operating procedure at the dump sites at Victory Base Camp are that they separate the waste anyway.

Q Oh, really? Oh, okay.

MR. VALDES: And the reason for that is that they find all kinds of crazy stuff in the garbage, like bullets and other things that ought not to be thrown into the trash. And since they're currently burning the waste or landfilling it, they were concerned that tossing the garbage directly into an incinerator when it hasn't been sorted, if there's anything in there like bullets or -- in one case, they actually found a gun, a handgun that was loaded, you know.

So they actually have third-country nationals there that are paid to sort the garbage.

Now, the flip side of your question, though, is resistance -- (brief audio break) -- the Army on switching to another source of fuel. And initially that was a concern we had, because, you know, the simple answer is, use JP-8 for everything. It powers your stove, powers your generators. It powers your tanks. So you only have to ship one thing. But what we've found is that with the convoys getting attacked at the rate they're getting attacked -- (brief audio break) -- thing that I heard the Army say is, we don't calculate the cost of fuel in dollars, we calculate it in blood. So to the extent that we can keep convoys off the roads, I think everyone is now seeing that this has value.

Q Now just one other thing. So what about -- I don't know if this a concern at all, but because you're incinerating waste right now, that creates some electricity, right, or some -- (that wasn't right ?) -- that you get some fuel for that, don't you?

So I just want to know, how does this compare to incineration? And is --

MR. VALDES: No, actually -- it's an excellent question, because I've got a chart on that. When we did our first study of all these different techniques, the advantage to the incineration is that it can handle, like, a larger amount of trash. So it's good at a large dump site, where you have, like, just a huge amount of trash. But it's only about 10 percent efficient. So it produces probably eight times less energy than does TGER per volume of garbage.

Q And air quality, is that at all a consideration?

MR. VALDES: Well, incinerators now are fairly sophisticated with filtration, all that stuff. So I'm not sure that that's a real big issue. I think the issue for incineration is that, you know, it doesn't produce much energy and it requires the input of a large amount of fuel to burn the trash. The trash just doesn't burn by itself. You have to add fuel.

Q Right. So you need people doing that, in other words, right?

MR. VALDES: Well, that, and fuel going in, which means fuel you have to haul from someplace else.

Q Oh, right.

MR. VALDES: So what we're trying to really do here is two things, you know: try to reduce the amount of fuel that's got to be convoyed because those convoys are targets and get rid of the garbage. We have about a 30 to one reduction in garbage with TGER, in garbage volume, which is good, because that's fewer garbage trucks that you've got to have hauling stuff to the dump site. And those garbage trucks are also a risk.

MODERATOR: Great. Do we have any other questions?

Q I do, if we can go back to the really remedial stuff, or the non-technical. This -- TGER -- is it right next to the generator? How does the fuel get from TGER to the generator?

MR. VALDES: Okay, the generator is actually integral to TGER. It's actually built into TGER. Q Okay. Is that much more expensive than generators the Army is using right now?

MR. VALDES: It's a standard Army gen-set, so it's the same type of generator. It's a Kohler. It's just a standard 60 kW gen-set.

Q So you took the generator and added onto it.

MR. VALDES: Right.

Q Okay. If I missed this, I apologize, but when you are using TGER and you're converting the trash, how does that get started?

Doesn't that have a fuel to get it going, the way adding fuel to an incinerator to generate electricity?

MR. VALDES: Yes. In fact, I explained that earlier.

Q I apologize.

MR. VALDES: When we fire up TGER, it takes up to six hours to get it running at steady state. During that time, you're using fuel to power the generator.

Q Oh, that's the five-to-one. Okay, from there.

MR. VALDES: But then after that, as you get to steady state, where now you're producing the producer gas and the hydrous ethanol, then that starts to power the generator. And so you end up reducing the diesel drip into the generator down to about 5 percent. And the other 95 percent is trash fuel.

Q Okay, I get it. Thanks for connecting that thought.

MR. VALDES: Fuel from trash, I should say.

Q Is somebody always manning this?

MR. VALDES: Well, as I said, these are prototypes that are end- built basically. And they are not automated yet. Ultimately what we would like to have is a clean-sheet design, in which we can automate the whole thing, so that all you've got to do is throw trash in one end, and power comes out the other. The ideal is, it's got to be soldier-proof.

Q Okay.

So one part is generating the hydrous ethanol. And the other part is generating the pellets. Is there something then taking the pellets and doing something else with them?

MR. VALDES: Right.

The trash that becomes fuel pellets, those pellets are then fed into a down draft gasifier. And the gasifier doesn't burn them. It heats them and it breaks them down, into simple hydrocarbons that resemble low-grade propane. So the output of the gasifier is a syngas. That's like a low- grade propane. And that syngas is then blended with the hydrous ethanol. And then that's what goes into the generator.

Q So in the end, there's only one output into the generator. All of this stuff goes in; two different places. It gets worked on in two different ways and then comes together and blends and goes into the generator.

MR. VALDES: Actually, it all goes into one chute. All the trash, whether it's wet waste or whether it's cardboard and all that, goes into one chute. And then what happens is there's a wash step where food waste gets stripped out, and that goes into the fermenter. And then the solid waste gets ground up and turned into these type of fuel pellets. Those go into the down-draft gasifier. Then at the end, the gas that comes out of there and the hydrous ethanol that comes out then are blended. So it's like it all goes in

one hole, it gets split into two streams, you got two fuel streams coming out, they get blended and then put into the generator.

Q Okay. I'm good. Thanks. As long as there's no pop quiz on this.

MR. VALDES: (Laughs.) There will be a test.

MODERATOR: Great. Were there any other last-minute questions from Martin, Mark, before we conclude?

Q Well, I guess maybe just another open question. I mean, what's your sense -- obviously, it's promising enough that you're deploying them and you're testing them, but what's your sense for how these could be deployed in the Army? Is this something that will be broadly used? Is it more kind of it depends on the situation? What's your feeling?

MR. VALDES: I think the forward operating bases that are smaller are probably ideal for TGER because their percentage of food waste and stuff like that is higher than the amounts of the things like styrofoam and plastics. (Inaudible) -- really is a lot more efficient when it's got a higher concentration of that type of waste. The way I would see it deployed is you would plug the power output right into the grid that's powering that base.

Now, the other applications that are sort of non-Army I see are any time -- any sort of like a post-Katrina-type event. Where there's a disaster, there's always lots of garbage, lots of trash, and very little power.

We've also had some people from Navy very interested because you could put something like this on board a ship. And it turns out that the laws about dumping in the ocean are extraordinarily stringent, and so big ships are like floating cities. And so they also have waste problems. Q Just wanted to clarify one thing: So the electricity that's being used from this generator, is that going into the -- in these deployed units -- is that going into the grid? Or how is that being used?

MR. VALDES: Well, currently no, because at the site that they're located, there is no grid. But what we're doing is, the output is hooked up to all kinds of office trailers there. It's powering them. And then there's excess power. That power is a load bank.

Q Batteries or something?

MR. VALDES: Well, no, not for these prototypes. That's an option though for the future. You could charge batteries.

MODERATOR: Great.

If there are no other questions, we'll go ahead and wrap up. I think this will be an exciting story to track. And definitely as Dr. Valdes said, as we head into August, and actually the testing phase ends, maybe we can get another roundtable or provide a status update on how the program is going. Because as we can see by what's going on in Iowa right now, there are certainly applications, both in Iraq and within the continental United States, for applications such as this.

So again thank you everyone for participating in the call. Thank you, Dr. Valdes, for your time. And hopefully we'll have another roundtable, possibly on the same subject, sometime soon.

MR. VALDES: Sounds good. I'm heading over there Saturday to take a look firsthand. So I can come back. I'll have firsthand knowledge of what they're doing.

Q I'd love to hear about that.

MODERATOR: Excellent. We'll try to get a follow-up then.

MR. VALDES: Okay.

MODERATOR: Thank you so much.

MR. VALDES: Nice talking to you, everybody.

END.